Environment Canada Environnement Canada

ENVIRONMENT CANADA'S

REVIEW OF THE AGNICO-EAGLE MINES LTD.

WATER LICENCE APPLICATION

FOR THE

MEADOWBANK GOLD PROJECT

FEBRUARY 18TH, 2008

Canada

Introduction

Environment Canada is a science-based Department whose business is to help Canadians live and prosper in an environment that needs to be conserved and protected. Contributing to making sustainable development a reality in Canada's North is a priority for Environment Canada. The Department focuses on provision of scientific expertise for incorporation into decisions on developments, such that all parties working together can ensure that there is minimal impact on the natural environment, and that ecosystem integrity is maintained and preserved for future generations.

Mandate, Role and Responsibilities of Environment Canada

The mandate of Environment Canada is determined by the statutes, regulations, guidelines, policies, federal, territorial, and international agreements, and related programs that it is assigned by Parliament to administer. The overall objective is to foster harmony between society and the environment for the economic, social and cultural benefit of present and future generations of Canadians. The Department shares this goal with other federal agencies, provinces, territories and First Nations.

The Department of the Environment Act provides Environment Canada with general responsibility for environmental management and protection. Its obligations extend to and include all matters over which Parliament has jurisdiction, not by law assigned to any other department, board, or agency of the Government of Canada as related to preservation and enhancement of the quality of the natural environment (eg. water, air, soil); renewable resources including migratory birds and other non-domestic flora and fauna; water; meteorology; coordination of policies and programs respecting preservation and enhancement of the quality of the natural environment; development of standards and guidelines; promotion of sound environmental practices and providing advice to federal government agencies. In delivering on these obligations Environment Canada has responsibility for specific legislation; regulations; policies and agreements.

Of particular concern and interest for the current project are the responsibilities conferred on the Department by legislation such as the:

- Canadian Environmental Protection Act
- Fisheries Act (Sections 36-42)
- Canada Water Act
- Migratory Birds Convention Act and Regulations
- Canada Wildlife Act
- Species at Risk Act

Relevant National policies and international agreements include the Toxic Substances Management Policy, National Pollution Prevention Strategy, UN Convention on Biological Diversity, National Biodiversity Strategy, Arctic Environmental Protection Strategy, Montreal Protocol on Ozone depleting Substances and the National Action Program on Climate Change.

Background

Meadowbank Mining Corp. (MMC) is proposing to construct, operate, and eventually decommission a gold mine in the Kivalliq region of Nunavut, approximately 70 km north of the Hamlet of Baker Lake. The Meadowbank project consists of four main deposits which host estimated and probable open pit mining reserves of 2,768,000 oz of gold, which will be processed at a rate of 8,500 tonnes per day over an 8-10 year operating period.

Technical Comments and Recommendations

Environment Canada's review of the Meadowbank Gold Project Water Licence Application submitted by Agnico-Eagle Mines Ltd. in August 2007 included the Type A water licence application and supporting documents. Our review focuses on areas which fall under the Department's mandated responsibilities, with our comments organized under the following headings:

1. General Comments
2. Groundwater
3. Water Quality
4. Tailings and Waste Rock Management
5. Waste Management
6. Emergencies
7. Closure and Reclamation
8. Conclusion

Within each category, comments are organized by specific issue, with reference to the appropriate document section, and detailing our concerns and recommendations.

Issues relating to fish and fish habitat fall outside of EC's mandate, and therefore are not addressed in this submission. Further, EC does not currently have available expertise for permafrost issues, the marine environment, hydrology and climate, and suggests the Board consider seeking expert advice on these aspects.

Although EC no longer has in-house groundwater expertise available, we have included comments which were provided by DFO's consultant as follow-up on groundwater issues raised by EC in the NIRB process. EC gratefully acknowledges DFO's proactive role in obtaining this information as it pertains to EC's *Fisheries Act* responsibilities.

1.0 General

Environment Canada was pleased with the format of the water licence application materials, finding the documents well laid out and cross-referenced. The proponent has re-visited issues raised by EC in the Environmental Assessment process, and has substantially addressed many of them. However, our review has identified several areas needing further work or clarification. These are outlined in our technical comments which follow.

2.0 Ground Water

2.1 Baseline Ground Water Quality Data

References:

Golder Associates Ltd. 2007c. Meadowbank Gold Project – 2006 Baseline Ground Water Quality, August 16, 2007.

Golder Associates Ltd. 2007d. Meadowbank Gold Project – 2007 Baseline Ground Water Quality, Submitted to Agnico-Eagle Mines Ltd. December 12, 2007.

Proponent's Conclusion:

In 2006, Golder Associates installed three new ground water monitoring wells, MW06-05, MW06-06 and MW06-07, to replace monitoring wells, MW03-02, MW03-03 and MW03-04, that had become inoperable. The configuration (location, depth, orientation and position of the screened interval) of two of the wells, MW06-06 and MW06-07, was similar to that of the old wells to facilitate comparison of the water quality data between monitoring years. The third well, MW06-05 was completed in IV rock on Goose Island but developed internal damage before it could be sampled and had to be abandoned. As a result, ground water samples were only collected from well MW03-01 on August 8 and August 14, 2006, from well MW06-06 on August 24, 2006 and from well MW06-07 on August 30, 2006. In 2007, wells MW06-06 and MW06-07 were also found to be defective and, therefore, only one sample was collected from well MW03-01 on August 17, 2007.

In the report on the 2006 Baseline Ground Water Quality, Golder concludes:

> *The database of groundwater chemistry data obtained to date is considered adequate for the purpose of evaluating the load of dissolved metals from groundwater since dissolved metal concentrations showed good correlation between data sets. It is also considered adequate to predict the salinity and major ion concentration of groundwater inflow into pits during operation.*

And in the report on the 2007 Baseline Ground Water Quality, they conclude:

> *The groundwater quality at MW03-01 has remained fairly consistent between 2006 and 2007, supporting the contention that the 2006 data constitute adequate baseline information for the areas investigated.*

Reviewer's Conclusion:

There are several problems concerning the reporting and use of the total dissolved solids data particularly in the most recent report on the 2007 Baseline Ground Water Quality. First of all, TDS concentrations were not analyzed as a separate parameter for the 2003 and 2004 samples whereas TDS concentrations were analyzed separately in the 2006 and 2007 samples. To compare data for all years Golder have calculated TDS concentrations from the individual analyses for each sample but have not always reported calculated values in Table 1 of the 2007 report (e.g. TDS for 2006 samples 12567-01 and 12567-02 are measured TDS rather than calculated values as indicated in the table). A comparison of measured versus calculated values for the 2006 and 2007 samples indicates that calculated values are always lower than the measured values probably due to the underestimation of the constituent parameters used to compute the calculated values and, therefore, it is more conservative to report and use measured TDS concentrations where these are available. Furthermore, in evaluating the results from the 2007 samples, the reviewer has not been able to reproduce the calculated TDS

concentrations from the analytical results and is, therefore, uncertain as to how they were computed.

Secondly, calculation of the ionic charge balances for the 2007 samples gives a difference of about 15% for each sample indicating that one or more of the chemical constituents in the analyses may not be particularly accurate. Standard error analysis would suggest that a TDS value calculated from several analytical values is less precise than the value from a single direct analysis.

Thirdly, the TDS value of 296 mg/L reported in Table 2 for the 2007 analysis appears to be an average of the two values calculated from the lab analyses (249 mg/L and 250 mg/L) and the TDS calculated from field measurements of electrical conductivity (389 mg/L). One of the lab analyses is a field duplicate. Field duplicates should not be used as separate data points for calculating averages for samples from one site. They should be averaged first and then used as a single set of data for calculating averages for the site. In addition to the problems with using calculated values of TDS, the conversion of electrical conductivity to TDS uses a somewhat arbitrary conversion factor (factor should be between 0.55 and 0.75 depending on the ionic composition of the fluid). Field TDS values are, therefore, not all that accurate. In summation, the reviewer contends that the average TDS for the 2007 ground water samples that should be reported in Table 2 is 319 mg/L; that is, the average of the lab analyses of 299 and 338 mg/L for samples 8581-01 and 8581-02 respectively. Results from previous years that use calculated instead of measured values of TDS, use field duplicates as separate data points and use field conductivity measurements to calculate average TDS need to be reevaluated.

The derivation of the TDS concentration with depth profile for the Meadowbank site (TDS profile) and the prediction of the ground water quality upwelling in the open pits provided during the EIS review used ground water quality analyses from the first round of sampling in 2003 only. During the EIS review, however, data were available from the 2004 round of ground water sampling and TDS concentrations in well MW03-01, for example, showed a rather large difference between 2003 (793 mg/L) and 2004 (1335 mg/L). Since the derivation of the Meadowbank Profile was based on the maximum TDS concentration from the 2003 data only (793 mg/L), there was a concern about the discrepancy between the 2003 and 2004 data and the predicted quality of the ground water upwelling in the open pits using the 2003 data only. Further rounds of ground water sampling to resolve some of the discrepancies in the data from the first two rounds of samples and to update predictions of brackish water upwelling in the open pits were recommended.

Subsequent sampling has shown that TDS concentrations at all sites are below 793 mg/L and would seem to indicate that the value of 1335 mg/L in 2004 at well MW03-01 may be an anomalously high value. The reviewer concurs with the proponent that the database of ground water chemistry data obtained to date is considered adequate to predict the salinity and major ion concentration of ground water inflow into the open pits during operation.

In their evaluation of the ground water quality results in the 2006 Baseline Ground Water Quality report, Golder states:

> *Metal concentrations in groundwater were compared to the Metal Mining Effluent Regulations (MMER; DFO, 2002) since water accumulating in the pits will be pumped to the stormwater attenuation ponds, and the water from these ponds*

will be monitored prior to discharge to Third Portage Lake. For consistency with the previous report, groundwater quality was also compared to the Canadian Council of Ministers of the Environment's (CCME) Canadian Environmental Quality Guidelines (CEQG, updated 2003) for the protection of freshwater aquatic life. This comparison is qualitative only as groundwater in the pit will not be discharged directly to the environment. Guidelines for metals are defined for total rather than dissolved phases in both the CEQG and MMER.

Although ground water will be pumped to the stormwater attenuation ponds during active mining in the pits, groundwater it will be left to flood the pits after mining is done and eventually the water in the pits will be connected to Third Portage Lake again. The pits will also likely continue to be points of ground water discharge to the lake that were not there prior to mine development and higher salinity layers may develop at the bottom of the pits due to a lack of mixing in the deeper water layers of the pits. Comparison of metal concentrations in ground water to the Canadian Environmental Quality Guidelines for the protection of freshwater aquatic life is, therefore, not an academic exercise.

Concentrations of total and dissolved metals in the 2006 and 2007 samples are generally lower than the 2003 and 2004 samples The database of ground water chemistry is also considered adequate for the purpose of evaluating the load of dissolved metals from ground water since dissolved metal concentrations exceeded the more stringent CEQG for the protection of freshwater aquatic life in only a few instances and were generally below analytical detection limits. Nevertheless, concentrations of a few constituents such as aluminum, chromium, copper and iron above the CEQG persist and will need to be monitored.

Reviewer's Recommendations:
The reviewer recommends that more robust permanent ground water quality monitoring wells be installed at the Meadowbank site as soon as possible and ground water quality samples be collected and analyzed to establish baseline ground water quality at the permanent sites prior to the start of active mining. The new baseline data should initially be compared to the existing baseline data to determine whether there are any significant variations between the two data sets.

2.2 Revised Predictions of Brackish Water Upwelling

References:
Golder Associates Ltd. 2006. Update to Predictions of Brackish Water Upwelling in Open Pits Meadowbank Project, Nunavut. Submitted to Cumberland Resources Ltd. December 5, 2006.

Golder Associates Ltd. 2007a. Revised Predictions of Brackish Water Upwelling in Open Pits Meadowbank Project, Nunavut. Submitted to Cumberland Resources Ltd. March 26, 2007.

Golder Associates Ltd. 2007b. Updated Predictions of Brackish Water Upwelling in Open Pits with Mining Rate of 8500 TPD, Meadowbank Project, Nunavut. July 27, 2007.

Proponent's Conclusion:
Following the third round of sampling undertaken during the 2006 field season, Golder developed a revised TDS concentration with depth profile (TDS profile) for use in the

ground water model used to predict brackish water upwelling in the open pits. In the Golder report on Update to Predictions of Brackish Water Upwelling in Open Pits, dated December 5, 2006 Golder states:

> *One of the commitments arising out of the NIRB hearings of Cumberland's Meadowbank Project was to conduct a third groundwater sampling round at the Project and then use the maximum TDS values from the three sampling rounds to develop a revised TDS concentration with depth profile (TDS profile). The revised TDS profile was then to be used to simulate saline groundwater upcoming in to the pits over the life of the mine.*

As well, they also revised the hydraulic conductivity of the Bay Zone Fault as noted in the following paragraph:

> *Permeable, continuous fractured rock zones are assumed to be associated with both the Second Portage and Bay Zone Faults in the model. Based on the results of packer testing carried out in the Second Portage Fault, a permeable fractured rock zone is assumed to be present, having a width of 5 m and a hydraulic conductivity of 1 x 10^{-5} m/s from the ground surface to 500 in depth. Results of packer testing carried out in the Bay Zone Fault have not indicated that this fault zone is hydraulically significant: however, it is assumed that the Bay Fault zone also consists of a 5 m fractured rock zone with an enhanced hydraulic conductivity of 1 x 10^{-5} m/s. Below 500 m depth, the hydraulic conductivity of both of these fractured rock zones is assumed to be reduced by one order of magnitude. Explicit in this assumption is that the fractured rock zone is hydraulically connected throughout it entire assumed extent. It is considered unlikely that a 5 m wide fractured rock zone would be so well connected over such large distances. Rather it is more likely that the portions of the fractured rock zone would be well sealed with low hydraulic conductivity values resulting in hydraulic connection only over much shorter distances.*

In the report Revised Predictions of Brackish Water Upwelling in Open Pits, dated March 26, 2007, Golder made further updates to the model (referred to as the 2007 model). These updates include i) a revised hydraulic conductivity with depth profile; ii) inclusion of seepage through dikes and the underlying cutoff wall in the shallow sediments; iii) provision for drainage of the pit slopes; and iv) improved representation of the dike and pit designs in the model.

And finally in the report Updated Prediction of Brackish Water Upwelling in Open Pits with Mining Rate of 8500 TPD, dated July 27, 2007 the consultants have provided predicted ground water quantity and quality estimates for an accelerated rate of mining at the Meadowbank site.

Reviewer's Conclusion:

In the requirements arising out of the NIRB hearings it is not specified that the maximum TDS concentrations from the three rounds of sampling should be used to develop a revised TDS concentration with depth profile. A third round of sampling was needed to resolve some of the discrepancies from the first two rounds of sampling in 2003 and 2004. The TDS profile used in the EIS was developed from the 2003 data only. Higher TDS values from the 2004 sample set raised concerns as to whether the TDS profile was predicting the worst case scenario. By using the maximum TDS, the model likely gives the worst case scenario and, therefore, there is likely some conservatism built into the results.

The hydraulic conductivity values for the various layers assumed in the revised hydraulic conductivity profile are, in general, slightly higher than those used in the modeling for the EIS. Aside from the other changes made to the model, the predicted ground water inflow quantities are slightly higher as a result than those predicted in the EIS.

An enhanced hydraulic conductivity for the Bay Zone Fault was not considered in the original simulations. Previously this fault was considered to have the same hydraulic conductivity as the surrounding intact bedrock and, therefore, it had no influence on the quantity and quality of ground water upwelling into the open pits. By assigning it a higher permeability, the model predictions result in greater ground water inflows with higher average TDS concentrations to the open pits. Testing of the hydraulic conductivity of the Bay Zone Fault was not done during the 2006 field program (new wells were not installed in the vicinity of the Bay Zone Fault in 2006). There is likely some conservatism built into the results by using the higher hydraulic conductivity for the Bay Zone Fault but additional data would be useful to confirm this assumption.

The ground water inflows to the open pits are generally two or more times greater than those predicted in the EIS and generally result from the revised hydraulic conductivity profile used in the 2007 model, i.e. the drainage of the pit slopes for stability, the inclusion of seepage in the shallow sediments, slightly deeper pits and an enhanced hydraulic conductivity for the Bay Zone Fault.

The use of the maximum TDS concentration to develop a revised TDS concentration with depth profile (TDS profile) results in a significant increase in the model predicted average TDS concentrations of brackish water upwelling in the open pits. Additional changes were made to the model (2007 model) to include seepage in the shallow sediments and drainage of the pit slopes. Although not discussed in the report Revised Predictions of Brackish Water Upwelling in the Open Pits, dated March 26, 2007, the lower average TDS concentrations predicted by the 2007 model may be due to higher inflows of better quality ground water through the shallow sediments. With the accelerated mining proposal, slightly higher average TDS concentrations are predicted for the brackish water upwelling in the open pits.

There are several assumptions built into the model that likely result in conservatively high predictions of inflows and average TDS concentrations of brackish water upwelling in the open pits. The use of the maximum TDS from the field sampling to develop the TDS profile used in the model and the use of an enhanced hydraulic conductivity for the Bay Zone Fault are two such examples. The reviewer also concurs with the consultant's reasoning that the reduction in hydraulic conductivity with depth is likely greater than is incorporated in the numerical model. A greater reduction in hydraulic conductivity with depth would lower the average TDS concentrations in the mine water. As well, the reviewer also concurs with the assumption that the fractured rock zones associated with the Second Portage and Bay Zone Faults are hydraulically connected throughout their entire extent. As indicated by the consultant, it is more likely that portions of the fractured rock zones are well sealed with low hydraulic conductivity values resulting in lower inflows and average TDS concentrations of water flowing to the pits.

In conclusion, the estimates of total flows and average TDS concentrations of brackish ground water predicted in the report dated July 27, 2007 for the accelerated mining rate of 8500 TPD are considered reasonably conservative and may be used in the site water

balance model (GoldSim model) to predict overall water balances and water quality for the site. As mining progresses, however, monitoring of the quantity and quality of ground water inflows to the open pits will be needed to verify these predictions and water management plans may need to be reviewed and updated depending on the results of the monitoring.

Reviewer's Recommendations:
The reviewer recommends that some updating and rerunning of the model be considered as data become available during the early stages of mining at the site. However, as mining advances, the need for predictive modeling will be replaced by the collection of actual monitoring data from the site.

2.3 Ground Water Monitoring Installations

References:
Golder Associates Ltd. 2007c. Meadowbank Gold Project – 2006 Baseline Ground Water Quality, August 16, 2007.
Golder Associates Ltd. 2007d. Meadowbank Gold Project – 2007 Baseline Ground Water Quality, Submitted to Agnico-Eagle Mines Ltd. December 12, 2007.

Proponent's Conclusion:
In the 2006 Baseline Ground Water Quality report Golder states:

> *The configuration of the replacement wells (location, depth, orientation and position of screened interval) is similar to that of the old wells to facilitate comparison of groundwater quality data between monitoring years. The well construction materials utilized were also similar to those used previously. Given the fragility of the PVC well constructions in the permafrost environment of Meadowbank, consideration was given to utilizing more robust construction materials such as stainless steel, which is considerably heavier and more expensive than PVC. Nevertheless, PVC was selected as the material of choice for the following reasons:*
>
> - *Short life span of the wells. Wells installed within the footprint of the pits will be destroyed shortly after operation is initiated. Should the project go ahead, the wells would be replaced with more permanent and robust structures which would be located outside the outline of the first years of pit operation.*
> - *Economics and relative ease of installation. The use of lighter PVC equipment allowed for conventional means of transportation of the material to site and well installation using standard equipment available at the site.*

They go on to note in the 2007 report:

> *Property ownership transfer and intense camp activity that occurred in 2007 precluded the completion of two sampling rounds and the replacement of defective wells. Out of the 7 monitoring wells installed at the site since 2003, one well remained operable.*

They further indicate in the 2007 report:

> *Monitoring well design and installation methods have been reviewed and are being revised to improve the robustness of the next generation on installations.*

Reviewer's Conclusion:
The high degree of failure of the well installations is disappointing but the reviewer is assured that a better understanding of the baseline groundwater quality has been

obtained even though the reliability of the installations has been limited. The installation of the three replacement wells near the sites of the original wells is a required procedure that will allow comparison of the successive sets of ground water quality data even though the sites will eventually be destroyed by the mining development. Subsequent installations, however, should be placed outside areas of direct development such that they can provide a more permanent monitoring capability and, in addition, the design of the new installations needs to be revised, as suggested, to improve their reliability.

Reviewer's Recommendations:
The reviewer recommends that more robust permanent ground water quality monitoring wells be installed at the Meadowbank site as soon as possible and ground water quality samples be collected and analyzed to establish baseline ground water quality at the permanent sites prior to the start of active mining.

3.0 Water Quality

3.1 Lake Sediment Removal

Reference:
Mine Waste and Water Management Report; Section: 8.1; Page: p. 8-1

Proponent's Conclusion:
Between 670,000 and 1,340,000 cubic meters of soft sediments will be removed from lake floors. Once frozen, removal will be done using conventional equipment, possibly requiring ripping or blasting. Disposal of the tailings dike sediments will be to the tailings impoundment, and lake bottom sediments removed during mine development will be placed in the area between the North Portage deposit and the East Dike, where they may consolidate and be available for later reclamation use.

Reviewer's Conclusion:
Removal of lake bottom sediments will involve handling of saturated materials which are high in several metals (As, Cd, Cr, Cu, Pb, Hg, Ni, and Zn), and having a fine clay/silt particle size. The relatively limited volume to be placed upstream of the tailings dike following excavation of the footing area should not significantly compromise supernatant quality. With respect to the balance of the lake bottom sediments, placement in the footprint of the Portage pit lake may represent a liability when the area is re-watered and may negatively impact water quality during re-watering as a result of suspended solids and metal concentrations. Given the high metals content and fine particle size, it is unlikely that the sediments would be useful for terrestrial reclamation purposes. As the proposed disposal area is shallow (2-8 m maximum), consideration should be given to disposal to the bottom of the Portage pit prior to flooding, or other disposal methods where the materials will be effectively isolated from wind and wave action following rewatering.

Reviewer's Recommendations:
Options for disposal of lake bottom sediments should be refined and disposal methods developed that minimize the potential for effects on surface waters. This may simply involve placing materials in deeper areas of the lake floor, and ensuring that a minimum water cover depth will be overlying at closure.

3.2 Dewatering of Lakes

Reference: Mine Waste & Water Management Report; Section: 9.1, Page: 9-1 Section 12 Table 12.1

Proponent's Conclusions:
The report describes dewatering of areas behind dikes, and has identified the potential for sediment displacement or slumping, and associated elevation of suspended solids and metals in the water to be discharged. Several mitigation techniques may be used, such as adjusting pumping rates, use of silt curtains, or use of settling ponds, to ensure water clarity/quality is acceptable for release.

Reviewer's Conclusions:
Use of 60% as the proportion of water which can be drawn down untreated is reasonable, based on Diavik's experience during pool dewatering in the open water season. It is not clear how the balance of potentially turbid water will be treated before discharge. Table 12.1 shows Portage Pit dewatering of 4.57 Mm^3 to Third Portage, and 0.39 Mm^3 (or 8.5%) being discharged to the attenuation pond. Goose Island Pit will have 1.47 Mm^3 dewatered to Third Portage Lake, and 0.007 Mm^3 (or 0.5%) pumped to the attenuation pond. Table 12.2 does not show the dewatering volumes expected to go to Wally Lake in Year 4 from Vault Lake.

Reviewer's Recommendations:
Dewatering discharges will need to be of sufficient quality and clarity that receiving water bodies are not adversely impacted. EC recommends that there be discussion regarding what would be protective limits to set for this activity, and how the proponent will achieve them. Such limits should be in the order of 15 mg/L TSS, and include total metals parameters.

3.3 Effluent Quality Criteria and Water Treatment

References:
Proposed Discharge Water Quality Criteria for the Portage and Vault Attenuation Ponds;
Water Quality Predictions August 2007 Report;
Proposed Water Treatment Methods August 2007 Technical Memorandum;

Proponent's Conclusions:
Discharges from the Attenuation Ponds are predicted to meet Metal Mining Effluent Regulations criteria without treatment. The Water Quality Predictions Report refers to various elevated parameters in the reclaim water at closure, and notes that it may be treated prior to release to the pit lakes. The Proposed Water Treatment Methods memorandum states that achieving drinking water guidelines in pit water will be the deciding factor in determining whether to treat reclaim water prior to discharge to the pit. If treatment is needed, the process circuit may be converted into a treatment plant to treat remaining tailings water at closure. The Water Quality Predictions Final Report states that Goose Island pit lake water will be treated *in situ* if necessary.

Reviewer's Conclusions:
Receiving waters in the project area contain very low concentrations of all parameters, and are ultra-oligotrophic with respect to having low nutrient levels and productivity. Ecosystems are based on very simple food webs, and as such are vulnerable should impacts occur to any compartment of the ecosystem. A very high level of protection is warranted when discharging effluent into such a pristine system, and it must be noted that the MMER discharge criteria provide only a minimum national standard for discharge quality, as these criteria were not developed based on biological impacts. Water treatment will almost certainly be required for reclaim pond discharges, and very possibly for pit lakes and attenuation ponds, depending on water quality.

All effluent discharged should pass acute toxicity tests using rainbow trout and *Daphnia magna*.

Reviewer's Recommendations:
It is important that impacts to water quality be avoided (where possible) or minimized through the implementation of mitigation measures, including using best available water treatment practices. Conceptual plans for water treatment have been provided, and MMC should strive to ensure that end of pipe discharge levels are as low as possible prior to discharge.

Effluent quality criteria should be set in the water licence which are protective of the receiving environment, and consistent with other mining operations operating in the NWT and NU where experience has not demonstrated unacceptable impacts have resulted.

3.4 Water Quality Predictions – Cyanide Degradation Products

Reference:
Water Quality Predictions August 2007 Report

Proponent's Conclusions:
Regarding inclusion of cyanide (CN) degradation products in ammonia predictions, the report summary says that the Portage model does not consider CN contributions to ammonia; page 32 states that free and weak acid dissociable (WAD) CN readily degrade to HCN and volatise and are therefore not considered in the model.

Reviewer's Conclusions:
WAD CN does not include the degradation products cyanate (CNO) or thiocyanate (SCN), which will remain in the water column and will degrade to form ammonia. This was seen at the Colomac mine, where an annual progression in the tailings and Zone 2 pit chemistry was observed as SCN and CNO dropped and ammonia and nitrate increased over time. It is not clear whether predictions for ammonia in reclaim water included CNO and SCN breakdown products; if not, ammonia levels may have been significantly underestimated.

Reviewer's Recommendation:
MMC should clarify whether ammonia predictions for the reclaim pond included all CN breakdown products, and if not, adjust ammonia predictions to account for these

sources. EC asks that the proponent commit to periodic re-calibration of the water quality predictions modeling for parameters of concern.

3.5 Water Quality in Pit Lakes

Reference:
Water Quality Predictions Section 6.2.1
Reclamation and Closure Plan

Proponent's Conclusions:
The long-term Portage and Goose Island pit lake water quality will meet the MMER limits for all constituents. Portage pit will develop a chemocline approximately 30 m from bottom of the pit, with TDS concentrations of about 1000 mg/L. The chemocline will slowly erode due to groundwater seepage out and through gradual mixing with the overlying waters. Vault pit is predicted to also likely develop a chemocline.

Reviewer's Conclusions:
With respect to the Portage pit post-closure chemocline disappearance, there is uncertainty as to whether the chemocline will erode. Groundwater outflow will be at a very, very slow rate, and it is unclear where the energy for mixing at the interface will come from. If mixing is attributed to diffusive processes, these are also very slow, and may not be enough to result in mixing. A deeper chemocline is predicted to develop in Vault pit, and would be less likely to erode given the lack of a talik connection to groundwater. It is unclear why the potential for stratification is not predicted for Goose pit.

Ground water discharges to the pits are not included in the GoldSim model during flooding after mine closure, i.e. the ground water taps are turned off at the end of active mining. During flooding of the pits, ground water discharges will continue but will decrease from those quantities occurring at the end of active mining to zero discharge when the pits are fully flooded. These discharges will have some effect on the overall water quality in the pits. Third Portage Lake level is higher than Second Portage Lake; therefore, ground water will eventually flow out of the open pits once the water levels in the pits reach the level of Third Portage Lake.

Modelling of the evolution of pit lake water quality was also done independently of the GoldSim modelling using the model CE-QUAL-W2. It is unclear whether ground water discharge was taken into account in this model. If ground water discharge is not included in the modeling, the chemocline will be thicker than estimated by the proponent but by how much will depend on the proportion of ground water discharge to other sources of flood waters to the pits.

Reviewer's Recommendations:
EC recommends that water quality criteria be set as a prerequisite to be met prior to removal of the dewatering dykes, in order to ensure protection of the receiving environment.

Clarification of the role of groundwater inputs/discharges in the evolution of pit water quality is requested.

3.6 Aquatic Monitoring/EEM Integration

Reference:
Aquatic Effects Management Program Oct. 2005 report
Water Quality and Flow Monitoring Plan: Section 3.3.2

Proponent's Conclusions:
MMC has developed a management plan that integrates mitigation and monitoring (core monitoring, targeted studies and MMER EEM) over the life of mine. The AEMP describes the key elements, and details are to be provided in the form of "Sampling and Analysis Plans" (SAP) prior to mine construction.

Reviewer's Conclusions:
Overall, MMC has proposed a well-reasoned approach and we concur that the plans will evolve and there will be areas which warrant further discussion. The report notes that either gradient or control-impact study designs will be used, and it should be confirmed that sufficient baseline data has been collected to characterize the full range of natural variability and provide a basis for the study design selected. Other points of discussion would include sediment quality parameters, usefulness of zooplankton monitoring, sampling locations, and capturing seasonal effects. Linkage to the Surveillance Network Program and to adaptive management will be important.

Reviewer's Recommendations:
EC recommends that the construction phase SAPs be developed as early as possible, and circulated for review.

With respect to groundwater monitoring, the proponent has developed a general ground water monitoring plan as part of the overall water quality and flow monitoring plan but details on the proposed ground water monitoring installations are scattered through several documents. It would help understand the proposed ground water monitoring if the proponent consolidated these details in a more specific plan that includes a schedule for the phased installation of monitoring wells and a brief discussion of the reason for each installation.

4.0 Tailings and Waste Rock Management

4.1 Design Depth of the Long-term Active Zone

Reference:
Section 4 and section 5.2 Mine Waste & Water Management; 2.3.2.1 Impact of Global Warming on Site Conditions, Water License

Proponent's Conclusions:
The Proponent is relying upon the freezing of the problematic mine solid wastes (overburden, rock and tailings) to minimize the release of contaminants. For example, in section 5.2 MWWM (page 5-3) it is stated "As a further ARD control measure, the Portage RSF will be capped with a 2-m thick cover of acid-buffering UM rock at closure, The depth of cover was selected based on thermistor data, which indicates the depth of thaw (active layer depth) to be on the order of 1.5 m. The cover material would be

coarse to allow the development of convective cooling during winter, and insulation though trapped air within voids during summer."

Reviewer's Conclusions:
The design for the waste management facilities is to operate in perpetuity. However, the proponent has suggested an upper climate change within the next century in the order of 6 °C. Although the mine site will remain within the zone of continuous permafrost, the thickness of the active layer would likely deepen. Section 2.3.2.1 Impact of Global Warming on Site Conditions underscored this, stating that "the active layer thickness would be expected to increase, and the total thickness of permafrost may slowly reduce in time." The active layer is predicted to increase in thickness by 15 to 30%. This would appear to increase the active layer to the current design of 2 meters. Given the crucial function of this cover, the thickness of 2 meters would appear to be a minimum particularly in light of the potential factors such as pile geometry and configuration (i.e. more heating to a south-facing curved pile face resulting in deeper active zone), vegetation (or lack thereof) effects, placement errors and longer term climatic changes that may make the nominal thickness of 2 meters insufficient.

Reviewer's Recommendations:
The proponent should confirm the necessary thickness of the capping material to accommodate the active zone in the upper limit climate change simulation to ensure the capping material is effective in the long-term, and, that sufficient benign capping material is available to cover the required facilities.

4.2 Viable contingency for waste rock piles if freezing approach insufficient

Reference:
Water license application

Proponent's Conclusion:
No contingencies have been presented should early work on the waste rock piles indicate freezing would not be sufficient.

Reviewer's Conclusions:
Although it is appreciated that much effort has gone to establish preferred approach to manage mine rock waste, a contingency should be presented. It should be technically viable and mitigate concern. It may be inferred in the company's Adaptive Management Approach that contingency would be developed as necessary.

Reviewer's Recommendations:
The proponent should develop a contingency that if the preferred approach is inadequate, that it would commit to undertake to address the concern. By way of examples, and not meant to limit or direct the company's deliberations, such a contingency could be additional thickness of the cover, altering its permeability to air and water, accelerating vegetation, or even relocation or sustainable polishing of problematic drainages so as not to impact nearby fishery waters.

4.3 Environmental characteristics of the till

Reference:
2.3.5.3 Till & 4.1 Waste Rock Management, Water License Application

Proponent's Conclusions:
The section states "All samples of till, with exception of Third Portage trench soil piles, have no potential to generate ARD. The ARD potential of trench soil pile is due to the higher sulphide content of soil directly above the ore deposit. Table 2.17 summarizes MMER exceedances of till. Leachate for till materials was compliant with MMER." Table 2.17 indicates that 5 of 11 samples had exceedances of MMER pH, including trench samples from Third Portage and samples from Goose Island. Table 4.1 indicates that the Till has no ("none") acid drainage potential, low metal leaching potential and no restrictions for storage or use in construction. Ultimately, about half of the till will be incorporated into environmental structures, roadways and control measures at the mine.

Reviewer's Conclusions:
Sections 2.3.5.3 and 4.1 in the License application appear to be somewhat in conflict. Much of the soil would presumably overlie the ore body. Table 2.17 suggests a substantial portion may be problematic in terms of at least pH. Natural surface waters in the area appear to have low buffering capacity.

Reviewer's Recommendations:
The proponent should address if there is in fact a conflict in conclusions. If there is some problematic till, the proponent should describe the effect of any of this material being incorporated in roads, surface toppings or in the core will have bearing on their environmental performance. If this potentially problematic material would have a detrimental effect, the proponent should describe control measures that would be implemented to ensure that this problematic material is not inadvertently incorporated in those environmentally sensitive structures.

4.4 Defining the Plan to effectively segregate site mine rock

Reference:
Operational ARD/ML Sampling and Testing Plan (August 2007); Mine Waste & Water Management Section 5

Proponent's Conclusions:
Sampling and testing of waste materials produced at Meadowbank will be required during operation in order to segregate the potentially acid-generating (PAG) and/or metal leaching (ML) waste from the non-potentially acid generating (NPAG) waste, such that waste materials can be assigned to specific locations. Sampled materials should be inclusive of stripped overburden, drill core or pit walls, and blasthole cuttings. In consideration of the mining rate, test procedures should be rapid and easy to complete.

To identify the PAG materials, the proposed tests are to determine the total sulphur and total carbon (measure of estimated acid generating and neutralization potentials) content and to determine the net acid generation character. The criteria defining PAG is based on neutralization potential ratio (ratio of neutralization potential to acid generating

potential). A ratio of 2 or lower would be considered requiring special disposal as potentially acid generating.

The proponent reports that the metal leaching potential has been evaluated using shake flask extraction (SFE) and by measure in humidity cell tests. Given the length of time to perform these tests (24 hours and 24 weeks respectively) the company does not consider them practical to segregate wastes. It is suggested that total metal content could be used and subsequently be a rapid test method. The total metal tests could be conducted using x-ray diffraction (XRE) or multi-acid digestion followed by ICP scan. The mineralogy of all NPAG rock samples will also be described, recorded, and compared with the results of the total metal and SFE tests. No criteria are proposed to define metal-leaching material requiring special disposal.

Lastly, for each rock disposal cell, the neutralizing and acid-generating potential would be estimated and the relative total "loading" of each potential calculated. The company plans to report it annually.

Reviewer's Conclusions:

It is recognized than an Adaptive Management Approach is going to be followed in which techniques and environmental protection measures would be iteratively improved as understanding and experience is accumulated. However, with the excavation commencing soon, the company should be in a position to propose criteria for the metal leaching. Conversely, they should be in a position to substantiate a view that by controlling acid generation, either as measured by sulfur content or neutralizing potential or the ratio, the mine rock will be effectively segregated. As much of the initial excavated material will be incorporated into site infrastructure, these long-term features must be robust and environmentally protective.

The purpose of reporting the total neutralizing and acid potential in the rock cells is unclear. Is there a ratio or net magnitude that is a design criterion that has not been expressed in the license application?

Reviewer's Recommendation:
Relatively rapid and 'conservative' (i.e. ensuring problematic material do not become incorporated into sites where they become a liability) segregation of problematic mine waste is fundamental to environmental protection measures at many mining operations. A credible segregation system should be in place prior to excavation and based on best current understanding.

The role of potentially confounding factors should be recognized and accounted for in the segregation system. For example, such factors can include accounting for the presence of siderite (which can potentially overestimate the neutralizing capacity) or high moisture content, which can result in imprecise measures of arsenic using XRE.

The system should be audited periodically to affirm it continues to operate effectively and conservatively.

5.0 Waste Management

5.1 Waste Incineration – Compliance with the CCME Canada-wide Standards (CWS) for dioxins and furan emissions and the CWS for mercury emissions.

References:
Incineration Waste Management Plan
Landfill Design and Management Plan

Proponent's Conclusions:
An Incinerator Waste Management Plan (IWMP) has been developed following on commitments made during the Environmental Assessment process. The Proponent plans to incinerate used petroleum products, food waste and sewage treatment sludge and has committed to use a dual chamber, high temperature incinerator (yet to be selected). Incinerator ash will be disposed of by spreading within the landfill following limited testing for compliance with the Environmental Guideline for Industrial Waste Discharges (GN, 2002).

Compliance with the Canadian Council of Ministers of the Environment (CCME) CWS for dioxins and furans and mercury will be demonstrated through an incinerator monitoring program and detailed stack emission testing, in addition to implementing the IWMP.

Environment Canada's Comments:
Environment Canada commends the Proponent for committing to mitigate emissions as outlined above. As our Air Quality Specialist is unavailable before March 17th, we have to defer detailed evaluation of the IWMP, but would anticipate further discussion on aspects such as waste stream management, operator training and ash disposal.

EC would like to confirm that there are no plans for open burning.

5.2 Landfarm Operation - Treatment of metals, solvents, glycol and heavy oils

Reference:
Landfarm Design and Management Plan 7.1 Operations Plan

Proponent's Conclusion:
The proponent states that metals, solvents, glycol and heavy oils 'should not be introduced into the landfarm'.

Reviewer's Conclusion:
EC has some concern that soils and/or ice/snow contaminated with metals, solvents, glycol and heavy oils may find their way into the landfarm facility.

Reviewer's Recommendations:
The proponent should provide details on storage and treatment options for these contaminants, noting measures to ensure they remain outside the landfarm facility.

5.3 Landfarm Operation - Containment of higher than expected volumes of contaminated soil and/or ice

Reference:
Landfarm Design and Management Plan 4.0 Estimated Volumes of Material to be Treated at the Landfarm Facility

Proponent's Conclusion:
The proponent states that if a more capacity is required, a second landfarm cell could be constructed adjacent to or beside the existing landfarm.

Reviewer's Conclusion:
Should contaminated soil and/or snow/ice exceed expected volumes, there should be an efficient and workable plan in place for the safe containment of significant volumes regardless of season and location of spill.

Reviewer's Recommendations:
Should it be necessary to construct a second landfarm, the proponent should have a contingency plan in place whereby:

- Construction time has been considered
- There will be adequate personnel and equipment on site to facilitate construction of a second landfarm
- Construction materials, e.g., granular materials, HDPE liner etc, will be available.

5.4 Landfarm Operation - Spillway operation

Reference:
Landfarm Design and Management Plan 5.0 Water Management

Proponent's Conclusion:
With respect to the spillway proposed for the landfarm that is being designed to direct overflow to downstream contact water, what are the specific design components of the spillway that will prevent the potential release of PHCs to the environment?

Reviewer's Conclusion:
More detail is required describing the design components/specifications of this spillway.

Reviewer's Recommendations:
The proponent should specify what the design components of the spillway will be that will prevent the release of PHCs to the environment.

5.5 Landfarm Operation - Potential exceedances in sump volume

Reference:
Landfarm Design and Management Plan 5.0 Water Management

Proponent's Conclusion:
Snow melt volume will be based on a three week snow melt period; surface runoff will

drain to a sump and would be pumped out on an as-needed basis, once a trigger level of 75 cm of water in the sump is recognized.

Reviewer's Conclusion:
Careful monitoring will be required to ensure sump volumes are not exceeded during the snow melt period.

Reviewer's recommendations:
EC recommends regular onsite monitoring in order to ensure trigger points are recognized and excess volumes are transported to the oil-water separator for treatment as needed.

5.6 Landfarm Operation - HDPE liner integrity

Reference:
Landfarm Design and Management Plan 6.0 Proposed Landfarm Construction & 7.3 Landfarm Operational Procedures

Proponent's Conclusion:
The proponent states that the marker layer (0.3 m of graded sand and gravel) will serve as protection of the liner, and will prevent damage during mechanical operation of the landfarm.

Reviewer's Conclusion:
It may be difficult to ensure a consistent and minimum depth of 0.3 m over the liner system. Also, during the tilling process, inexperienced operators may inadvertently disrupt or tear through the marker layer and into the liner system.

Reviewer's Recommendations:
EC encourages the operators to take steps to prevent damage to the HDPE liner during mechanical operation of the landfarm, e.g., employ experienced operators, ensure an adequate depth of soil, ensure adequate depths of granular material (marker layer) covering the liner etc.

6.0 Emergencies

6.1 Hazardous Material Management Plan - Section 8.

Reference:
Meadowbank Gold Project's *Hazardous Materials Management Plan*, *Section 8 – Process Plant & Water Treatment Reagents & Consumables, Table 8.1 Use, consumption & Storage,* August 2007.

Developer's Conclusions:
Meadowbank proposes to use and store 75 tonnes of Hydrochloric Acid and approximately 7.9 tonnes of Hydrofluoric Acid (specific gravity of 1.15, 9.58 lbs/gal) as identified in Table 8.1 - Use Consumption and Storage.

Reviewer's Conclusion:

Under the Environmental Emergency Regulations (E2) under Part 8 of the *Canadian Environmental Protection Act, 1999* (CEPA), anyone storing or using a listed substance above the specified thresholds or who has a container with a capacity for that substance, will have to notify Environment Canada. Hydrochloric and Hydrofluoric Acids are regulated substances listed in Schedule 1 of the E2 Regulations. The threshold for Hydrochloric Acid in Schedule 1 of the E2 regulations is 6.80 tonnes at a concentration equal to or greater than 30% and for Hydrofluoric Acid the threshold is 0.45 tonnes at a concentration of 50% or more.

Reviewer's Recommendations:

1. Meadowbank must determine whether the maximum quantity of each substance or mixture used or stored at the place is greater than the threshold quantity listed in Schedule 1 of the E2 Regulations. If it is, you must comply with section 200 Regulations for that substance.

For more information on how to prepare and implement an E2 plan, refer to the *Implementation Guidelines for Part 8 of the CEPA*, 1999 or on Environment Canada's CEPA Environmental Registry at www.ec.gc.ca/CEPARegistry.

2. Spill reporting requirements under Section 201 of CEPA 1999 requires for any of the substances on the list established on Schedule 1, any person who has charge, management or control of the substance shall, as soon as possible, notify a CEPA Enforcement Officer. In addition, this person must abide by a number of other requirements, such as taking all reasonable measures consistent with the protection of the environment and public safety and providing a written report to Environment Canada.

6.2 Revisions required to Spill Contingency Plan

Table 5.2 Other Important Emergency Phone Numbers
Environment Canada's contact is (867) 766-3737 for a 24-hour emergency pager monitored by Emergency and Enforcement Officers. This contact information should be updated in AEM's other spill contingency plans as well.

A section should be added to the spill contingency plan which deals with the handling and disposal of hydrocarbon-contaminated materials that are too large to go to the landfarm. Experience at other northern open pit mines has recorded a high frequency of hydraulic fluid and other spills on rocks, which are difficult to clean up. In the case of both Ekati and Diavik such materials are being segregated inside the waste rock pile. MMC should specify what their intent is for dealing with such materials.

7.0 Closure and Reclamation

7.1 Removal of Dewatering Dykes

Reference:
Preliminary Closure and Reclamation Plan *7.2 Dewatering Dikes; 7.2.5 Restoration Plan*

Proponent's Conclusions:

Section 7.1.4 of the Closure and Reclamation Plan indicates that “all dewatering dikes will be kept intact to provide a barrier between the open pits and surrounding lakes until the pit lake water quality levels achieve static conditions and water quality is considered acceptable for discharge without treatment into the environment.”

Reviewer’s Conclusions:
The removal of the dykes could impact water quality in the affected lakes. Depending on the removal method chosen, water quality impacts could include increased TSS loadings, increased dissolved metal loadings from oxidization of exposed pit walls, and/or ammonia levels from blast residue (if blasting is used to remove dykes). It is also unclear if these potential impacts have been included in the water quality modelling. MMC will have to ensure that appropriate mitigation is identified and implemented for the chosen method.

Reviewer’s Recommendations:
Environment Canada recommends that further information regarding the method to be used to remove/breach the dewatering dykes be provided. Potential impacts of the chosen method should be discussed and mitigation measures identified.

7.2 Post-closure maintenance of dykes

*Proponent's conclusion*s:
The proponent states that the Central Dyke will remain to contain the stored mine tailings.

Reviewer's conclusions:
Will there be ongoing inspections to ensure there has been adequate freezing of the tailings and to ensure the central dike is preventing contaminated drainage into the Portage Pit? Post-closure, is there a maintenance plan in place that will regularly inspect and maintain the dewatering dikes as required?

Reviewer's recommendations:
EC recommends that the C&R Plan outline whether an inspection and maintenance program has been considered for the central Dike and to provide additional details on this program. The final design and construction of all dams/dikes should include provisions for:

- the worst possible case environmental events
- also recommended that best environmental management practices in Canada and elsewhere for dam design and construction be referenced in order to identify provisions for seepage collection and treatment; and
- a dam safety inspection and maintenance program should be prepared for post-closure

7.3 Tailings Storage Facility Closure

Reference:
Preliminary Closure and Reclamation Plan; *7.3 Tailings Storage Facility; 7.3.4 Proposed Closure Methods*

Proponent's conclusion:
The proponent states that the discharge water quality and the water management strategies for the TSF will be monitored and assessed according to an approved environmental protocol during each stage of the mine's life.

Reviewer's conclusion:
Insufficient detail has been provided concerning the environmental protocol describing the discharge water quality and the water management structures for the TSF; there is not enough detail provided on this 'approved environmental protocol' to assess the efficacy of this strategy.

Reviewer's recommendations:
EC recommends that more detail be provided on what the 'environmental protocol' would involve.

7.4 Monitoring program for the RSF areas.

Reference:
Preliminary Closure and Reclamation Plan *7.4 Rock Storage Areas; 7.4.4 Proposed Closure Methods*

Proponent's conclusion:
The proponent states that drainage water from the RSFs will be monitored during operation and post closure.

Reviewer's conclusion:
There is inadequate detail provided and we are therefore unable to evaluate whether objectives of the C&R Plan can be met.

Reviewer's recommendations:
EC recommends that there be discussion presented on what treatment/containment options will be employed should water quality of the drainage water be above guidelines or licence requirements. EC also recommends that testing be continued post-closure to verify expected behaviour of mine rock over the long term. In addition, a verification and field monitoring program for waste rock and the development of a contingency plan to deal with reactive material found in the non-mineralized waste rock storage piles is recommended.

7.5 Water Management Plan to minimize and control contaminated drainage

*Reference***:**
Preliminary Closure and Reclamation Plan; *7.1 Closure Factors; 7.1.2 Open Pit Workings; 7.1.4 Proposed Closure Methods*

Proponent's conclusion:
The prroponent will integrate a water management plan to minimize and control contaminated drainage.

Reviewer's conclusion:

There is inadequate detail in this section to explain how contaminated drainage will be minimized and controlled.

Reviewer's recommendations:

1. More detail is required concerning water quality monitoring to be carried out and subsequent treatment options (passive or active).
2. Will the water management plan contain contingencies in the event of high contaminant concentrations and/or high volumes?
3. More detail is required concerning the statement that new surface drainage patterns will be established.
4. The proponent states that the fill rate of the open pits will be based on the maximum acceptable drawdown in each lake. Have these maximum drawdowns been determined?
5. Has consideration been given to the need to inspect and possibly maintain the dewatering dikes until the pit lake water levels achieve static conditions and the water quality is considered acceptable for release to the environment without treatment?
6. Is the proponent aware that water license criteria may be more stringent than MMER and CCME guidelines?
7. EC recommends ongoing modeling and laboratory testing of evolving water quality in the flooded pit, of discharge rates and of the type and length of treatment required
8. EC recommends a strategy to reduce the time that the open pit walls will be exposed before the pit is flooded.
9. Potential seepage pathways between the open pit and local waterbodies could and should be monitored, using strategically placed groundwater monitoring wells, which would give ample warning if contaminants (using suitable threshold levels for contaminants) were migrating through the subsurface/bedrock. MMC would then need to take corrective action, which could presumably include continuing to pump and treat the water in the pit.

7.6 Closure of the Water Treatment Plant (if one is required)

Reference:
Preliminary Closure and Reclamation Plan

Proponent's conclusion:
Specific closure strategy for this potential facility is not included in this C & R Plan.

Reviewer's conclusion:
Details on closure practices for this facility (if required) are lacking.

Reviewer's recommendations:
Details on how this facility will be decommissioned (if one is required) should be included in the C & R report.

7.7 Progressively Closing the RSFs

Reference:

Preliminary Closure and Reclamation Plan; *Rock Storage Areas; 7.4.4 Proposed Closure Methods*

Proponent's conclusion:
The proponent states that “procedures will be modified as required to achieve the objectives of the C&R Plan”.

Reviewer's conclusion:
There is inadequate detail provided to evaluate whether objectives of the C&R Plan can be met.

Reviewer's recommendations:
EC recommends that additional information be provided that details what procedures will be modified and how and under what circumstances they will be modified.

7.8 *Post-closure monitoring of landfills and other waste management disposal areas*

Reference:
Preliminary Closure and Reclamation Plan Section 10 Closure of Landfills & Other Waste Management Disposal Areas; 10.4 Proposed Closure Methods

Proponent's conclusion:
The proponent has not presented a post-closure monitoring plan for the two proposed non-hazardous landfills.

Reviewer's conclusions:
More information is required regarding the nature of post-closure monitoring of the landfills to ensure:

- chemical characteristics of any landfill leachate and/or sludge
- the ground thermal regime hasn’t been compromised
- cover performance is maintained into the long term (e.g., has permafrost aggraded into the landfill etc.)
- the cover does not crack or slump over time.

Reviewer's recommendations:
EC recommends that the proponent develop a post-closure monitoring plan that outlines how all of the above will be monitored and, if required, mitigated for.

8.0 Conclusion

Environment Canada would like to thank the Nunavut Water Board for the opportunity to raise these technical issues, and we look forward to discussions at the Pre-Hearing Technical meetings.